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EXAMINER	
CRAIG, DWIN M	
ART UNIT	**PAPER NUMBER**
2123	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/20/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)
	10/760,522	NAKAMURA ET AL.
	Examiner	Art Unit
	Dwin M. Craig	2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-32* is/are rejected.

7)☒ Claim(s) *2,3,6, 9,10,11, 14,15,20, 21, 24, 27 and 28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8/12/04, 2/9/05*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. The information disclosure statement (IDS) submitted on 8/12/2004 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609, because, the IDS submitted on 8/12/2004, the reference entitled, Nakamura et al. "Impact of Development Reaction Products on CD in view of Developer Alkaline Concentration Deviation," SPIE (2001), p. 729, is a foreign language document and no English language translation has been provided therefore, while the reference have been placed in the application file, the information referred to therein has not been considered to the merits. Applicants' are advised that the date of any resubmission of any item of information contained in these information disclosure statements or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements under 37 CFR 1.97(e). See MPEP § 609, ¶ C(1). The other references in the 8/12/2004 IDS have been fully considered.

Claims herein under examination are 1- 32.

Specification

2. The title of the invention is awkward and does not clearly disclose the Applicants' inventive concept. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: "A Method of Predicting Pattern Shapes by measuring the Changes in a Photosensitive Photo-resist".

Claims Objections

3. Dependent claims 2, 3, 9, 10, 14, 15, 20 & 21 are objected to because the current claim language is grammatically awkward, for example, *"...wherein the optical intensities is an aerial image intensity..."* appears to have the wrong tense, the phrase, *"...wherein the optical intensities are aerial image intensities..."* would conform to current U.S. practice.

3.1 Claims 6, 11 and 24 are objected to because the following sentence is grammatically awkward, the phrase, *"...the photosensitive resist dissolves in initial stage of development..."* should read *"...the photosensitive resist dissolves in an initial stage of development..."*. Correction is required.

3.2 Claims 27 & 28 are objected to because of the following informality, as an example, the claim language currently states, claim 27 line 4 *"instruction configured..."* the examiner believes that the Applicants' wanted to claim a plurality of *instructions* and not a single instruction, clarification and/or amendment are required.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 1-24 and 29-31 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The currently claimed result of calculating a dissolution rate and then determining a pattern shape is claiming a mathematical result, which is a mathematical abstraction and fails to produce a *concrete, useful and tangible result* as required.

Further, the claim language fails to store or display the new predicted pattern shape and therefore fails to bring the resultant pattern shape in the real world.

4.1 Regarding claims 25-28, these claims are directed to software alone and fail to fall into any of the statutory categories, i.e. process, machine, manufacture or composition of matter, see MPEP section 2106.01 of the August 2006 edition. The claims are directed towards functional descriptive material, *the computer program product*, which is non-statutory when claimed with out being recorded on some computer readable medium. Further, the claims fail to disclose a useful concrete and tangible result as required by 35 U.S.C. 101, merely predicting a pattern shape fails to meet the requirements for a useful and tangible result.

See MPEP section 2107 of the August 2006 edition.

Amendment is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 7, 12, 18 and 28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5.1 Taking claim 7 as an example, the current claim language discloses the following, *"wherein the spatial average is calculated in reference positions moving along development time, which is different from the position where the pattern shape of the photosensitive resist is predicted"* it is unclear from the current claim how the spatial average is calculated in relation to

reference positions, that are moving along a development *time*. The reference positions could change as time goes by but the currently claimed different positions or regions of interest of the photosensitive resist would seem to be affected as time expires and the pattern shape is changed. It is unclear what is governing the movement of the reference positions and how this movement is affecting the calculation of the spatial average and further how these changes are affected by the passage of time.

5.2 Claim 28 is rejected under 35 U.S.C. 112 2nd paragraph because of the following claimed limitation, "*...reference positions moving along development time within the computer system*" it is unclear from the specification and the claims what is being claimed in regards to how what exactly is the *development time* and how *reference positions move* along that *time*, see the explanation above as well.

The claim language is confusing and fails to clearly disclose the *metes and bounds* of the claimed subject matter.

Amendment and clarification are required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1, 3 and 7 are rejected under 35 USC 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 in view of Hryhorenko U.S. Patent 6,221,563.

6.1 Regarding claim 1, *Mimotogi* teaches, *a computer implemented method for development profile simulation* (Figure(s) 4, 5 & 9 and the descriptive text and more specifically reference S26 in Figure 5 and Col. 6 lines 14-16 "...Profile Simulation Method...") *comprising: calculating optical intensities in a photosensitive resist;* (Figure 2 and the descriptive text; more specifically Col. 6 lines 45-56 the examiner notes that "calculating light intensity" is functionally equivalent to "calculating optical intensity") *calculating a spatial average value of the optical intensities;* (Col. 4 lines 17-18 "...calculating a spatial average...") *reading a measured*

changing ratio of a dissolution rate of the photosensitive resist (Col. 4 line 19 "...calculating a dissolution rate...") *changed by at least one of exposure dose on the photosensitive resist a position in the thickness direction of the photosensitive resist* (Figure 3 and Col. 6 lines 57-59) *and ... obtaining a calculated dissolution rate by using the spatial average value and the measured changing ratio;* (Col. 8 lines 34-67 and Col. 9 lines 1-67) *and predicting a pattern shape of the photosensitive resist* (Figure(s) 2 & 6 and the descriptive text and Figure 9 reference S34, The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches calculation of the change in the shape of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*) *from the calculated dissolution rate.* Further, all of the embodiments of the *Mimotogi* reference are cited herein.

However, *Mimotogi* does not expressly disclose, *reading a measured changing ratio of a dissolution rate of the photosensitive resist* <u>relating to</u> *an alkaline concentration changed by at least one of exposure dose on the photosensitive resist.*

Hryhorenko teaches *an alkaline concentration changed by at least one of exposure dose on the photosensitive resist* (Figure 7 and the descriptive text and more specifically Col. 6 lines 30-60 and Col..7 lines 29-48 and Col. 9 lines 44-48).

Mimotogi and *Hryhorenko* are analogous art because they are both from the same problem solving area of semiconductor manufacturing.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have simulated the effect of *alkaline concentrations* as disclosed in *Hryhorenko* with the semiconductor simulation methods of *Mimotogi.*

The motivation for doing so would have been to provide compatible and high resolution light emitting pixels and the capacity of achieving smaller pixel dimensions commensurate with pattern fidelity obtainable with an integral vapor disposition mask formed from a photo-resist materials (see *Hryhorenko* Col. 3 lines 5-21).

Therefore, it would have been obvious to combine *Hryhorenko* with *Mimotogi* to obtain the invention as specified in claims 1, 3 and 7.

6.2 Regarding claim 3, *Mimotogi* teaches *wherein the optical intensities are concentration of photoreaction products* (Figure 1 #18 and Col. 2 lines 3-11 and Col. 6 lines 40-44).

6.3 Regarding claim 7, claim interpretation, the examiner has given the claim language a broad reasonable interpretation, claim 7 discloses the following limitation, *"...wherein the spatial average is calculated in reference positions moving along development time, which is different from the position where the pattern shape of the photosensitive resist is predicted."* The examiner has interpreted this limitation to required that a prior art teaching disclose at least two regions of interest that are being considered when a spatial average is being calculated, *Mimotagi* teaches, Col. 11 lines 1-50, and teaches 2 regions of interest and their relationship to each other, further in Col. 11 line 11 a *spatial average* is being calculated in regards to the 2 regions of interest. Therefore the examiner believes that the teachings as discussed herein meet a reasonable interpretation of Applicants' claimed limitations.

7. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Mimotogi* as modified by *Hryhorenko* as applied to claims 1, 3 and 7 above and further in view of US Patent 6,280,887 Lu.

Mimotogi as modified by *Hryhorenko* teaches calculating optical intensities of a photo-resist and then calculating the dissolution rate in claims 1, 3 and 7 for the reasons above, differing from the invention as recited in claim 2 in that their combined teaching lacks,

(claim 2) wherein the optical intensities *are* an aerial image intensity.

Lu teaches (claim 2) wherein the optical intensities are an aerial image intensity (Figures 1D and 1H and Col. 1 lines 55-67 and Col. 3 lines 53-57).

Mimotogi as modified by *Hryhorenko* and *Lu* are analogous art because they are all related to photolithography for integrated circuit fabrication.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the *aerial intensity* methods of *Lu* with the calculation methods of *Mimotogi* as modified by *Hryhorenko* because *Lu* teaches that using the disclosed *aerial intensity* method allows for smaller features sizes in the in integrated circuit patterns allowing for smaller design rules and faster and more power efficient integrated circuits (see *Lu* Col. 15 lines 27-36).

8. Claims 4, 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Mimotogi* as modified by *Hryhorenko* as applied to claims 1, 3 and 7 above and further in view of US Patent 6,319,648 Reiser.

Mimotogi as modified by *Hryhorenko* teaches calculating optical intensities of a photo-resist and then calculating the dissolution rate in claims 1, 3 and 7 for the reasons above, differing from the invention as recited in claims 4-6 in that their combined teaching lacks,

(claim 4) *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to the alkaline concentration,*

(claim 5) *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to a logarithm of the alkaline concentration.*

(claim 6) *wherein the spatial average value is calculated in an area where the photosensitive resist dissolves in <u>the</u> initial stage of development.*

Reiser teaches, claims 4 & 5, the use of calculating a logarithm when determining the dissolution rate of photo resist used in microlithography (Abstract) and more specifically aqueous alkali solutions (Col. 1 lines 50-53) regarding the use of logarithms concerning dissolution rate calculations see (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13) and further teaches *dissolution* (claim 6) (Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example).

Mimotogi as modified by *Hryhorenko* and *Reiser* are analogous art because they are all related to photolithography for integrated circuit fabrication.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the *logarithmic dissolution rate calculation* methods of *Reiser* with the calculation methods of *Mimotogi* as modified by *Hryhorenko* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides

improved development of photo resists that are used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method of semiconductor manufacturing is accomplished, see (Col. 1 lines 66-67 and Col. 2 lines 1-11) of *Reiser*.

9. Claims 8 and 10-12 are rejected under rejected under 35 USC 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 in view of Reiser U.S. patent 6,319,648.

9.1 Regarding claim 8, *Mimotogi* teaches, *a computer implemented method for development profile simulation comprising:* (Figure(s) 4, 5 & 9 and the descriptive text and more specifically reference S26 in Figure 5 and Col. 6 lines 14-16 "...Profile Simulation Method...") *calculating optical intensities in a photosensitive resist;* (Figure 2 and the descriptive text, more specifically Col. 6 lines 45-56 the examiner notes that "calculating light intensity" is functionally equivalent to "calculating optical intensity") *calculating a spatial average value of the optical intensities;* (Col. 4 lines 17-18 "...calculating a spatial average...") *; and predicting a pattern shape of the photosensitive resist by using the calculated dissolution rate* (Figure(s) 2 & 6 and the descriptive text and Figure 9 reference S34 The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches calculation of the change in the shape of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*).

However, *Mimotogi* does not expressly disclose, *obtaining a changing ratio of a logarithm of a measured dissolution rate to an alkaline concentration of developer for the*

photosensitive resist or the changing ratio of the logarithm of the measured dissolution rate to a logarithm of the alkaline concentration of developer for the photosensitive resist; obtaining a calculated dissolution rate by using the spatial average value and the calculated changing ratio of the logarithm of the measured dissolution rate to alkaline concentration of a developer or the calculated changing ratio of the logarithm of the measured dissolution rate to the logarithm of an alkaline concentration of the developer. It is noted that *Mimotogi* does disclose calculation of a spatial average value see (Col. 4 lines 17-18 "...calculating a spatial average...") however *Mimotogi* does not expressly teach the combination of using the logarithm of a measured dissolution rate.

Reiser teaches *obtaining a changing ratio of a logarithm of a measured dissolution rate to an alkaline concentration of developer for the photosensitive resist* (Figures 1-4 and the descriptive text more specifically Col. 1 lines 50-53 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13) *or the changing ratio of the logarithm of the measured dissolution rate to a logarithm of the alkaline concentration of developer for the photosensitive resist;* (Figures 1-4, which disclose using logarithmic dissolution rates and regarding the alkaline concentration of the developer see the explanation in Col. 1 lines 48-67 and Col. 2 lines 1-11) *and a calculated changing ratio of the logarithm of the measured dissolution rate to alkaline concentration of a developer or the calculated changing ratio of the logarithm of the measured dissolution rate to the logarithm of an alkaline concentration of the developer;* (Figure 3 and Col. 1 lines 48-65 and Col. 4 lines 59-67, "...The plots are essentially linear and the absolute value of the negative slope of a given plot is the inhibition factor f for a given resin when present in a series of dissolution inhibition test compositions..." Applicants'

claims are describing the automation of the dissolution inhibition test calculations as disclosed and further and in regards to the calculated changing ratio the discussion of a *"slope"* and the other *"linear"* aspects of the testing and plotting clearly teach the calculation of dissolution rates).

Mimotoga and *Reiser* are analogous art because they are from the same problem solving area of microlithography as used in the fabrication of semiconductor devices.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the teachings of *Mimotoga* in combination with the teachings of *Reiser*.

The suggestion for doing so would have been to utilize the *logarithmic dissolution rate calculation* methods of *Reiser* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides improved development of photo resists that are used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method of semiconductor manufacturing is accomplished, see (Col. 1 lines 66-67 and Col. 2 lines 1-11) of *Reiser*.

Therefore, it would have been obvious to combine *Reiser* with *Mimotoga* to obtain the invention as specified in claims 8 and 10-12.

9.1 Regarding claim 10 *Mimotogi* teaches *wherein the optical intensities are concentration of photoreaction products* (Figure 1 #18 and Col. 2 lines 3-11 and Col. 6 lines 40-44).

9.2 Regarding claim 11 *Mimotogi* does not expressly disclose *wherein the spatial average value is calculated in an area where the photosensitive resist dissolves in initial stage of development,* however, *Reiser* teaches *dissolution* during development of a photo resist (Example

10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example).

9.3 Regarding claim 12 claim interpretation, the examiner has given the claim language a broad reasonable interpretation, claim 12 discloses the following limitation, *"...wherein the spatial average is calculated in reference positions moving along development time, which is different from the position where the pattern shape of the photosensitive resist is predicted."* The examiner has interpreted this limitation to required that a prior art teaching disclose at least two regions of interest that are being considered when a spatial average is being calculated, *Mimotagi* teaches, Col. 11 lines 1-50, and teaches 2 regions of interest and their relationship to each other, further in Col. 11 line 11 a *spatial average* is being calculated in regards to the 2 regions of interest. Therefore the examiner believes that the teachings as discussed herein meet a reasonable interpretation of Applicants' claimed limitations.

10. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 as modified by Reiser U.S. Patent 6,319,648 as applied to claims 8 and 10-12 above and further in view of US Patent 6,280,887 Lu.

Mimotogi as modified by *Reiser* teaches calculating optical intensities of a photo-resist and then calculating the dissolution rate in claim 8 for the reasons above, differing from the invention as recited in claim 9 in that their combined teaching lacks,

(claim 9) wherein the optical intensities *are* an aerial image intensity.

Lu teaches (claim 9) wherein the optical intensities are an aerial image intensity (Figures 1D and 1H and Col. 1 lines 55-67 and Col. 3 lines 53-57).

Mimotogi as modified by *Reiser* and *Lu* are analogous art because they are all related to photolithography for integrated circuit fabrication.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the *aerial intensity* methods of *Lu* with the calculation methods of *Mimotogi* as modified by *Reiser* because *Lu* teaches that using the disclosed *aerial intensity* method allows for smaller features sizes in the in integrated circuit patterns allowing for smaller design rules and faster and more power efficient integrated circuits (see *Lu* Col. 15 lines 27-36).

11. Claims 13 and 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 in view of Reiser U.S. Patent 6,319,648.

11.1 Regarding claim 13, *Mimotogi* teaches, *a computer implemented method for development profile simulation comprising:* (Figure(s) 4, 5 & 9 and the descriptive text and more specifically reference S26 in Figure 5 and Col. 6 lines 14-16 "...Profile Simulation Method...") *calculating optical intensities in a photosensitive resist;* (Figure 2 and the descriptive text, more specifically Col. 6 lines 45-56 the examiner notes that "calculating light intensity" is functionally equivalent to "calculating optical intensity") *calculating a spatial average value of the optical intensities in an area where the photosensitive resist dissolves in initial stage of development;* (Col. 4 lines 17-18 "...calculating a spatial average...") *using the spatial average value and the measured changing ratio; and predicting a pattern shape of the photosensitive resist by using the calculated dissolution rate* (Col. 8 lines 34-67 and Col. 9 lines 1-67 and Figure(s) 2 & 6 and the descriptive text and Figure 9 reference S34 The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches calculation of the change in the shape

of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*).

However, *Mimotogi* does not expressly disclose, *reading a measured changing ratio of a dissolution rate of the photosensitive resist relating to an alkaline concentration; and obtaining a calculated dissolution rate by using the spatial average value and the measured changing ratio.*

Reiser teaches, *reading a measured changing ratio of a dissolution rate of the photosensitive resist relating to an alkaline concentration;* (Figures 1-4, which disclose using logarithmic dissolution rates and regarding the alkaline concentration of the developer see the explanation in Col. 1 lines 48-67 and Col. 2 lines 1-11) *and obtaining a calculated dissolution rate* (Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example).

Mimotoga and *Reiser* are analogous art because they are from the same problem solving area of microlithography as used in the fabrication of semiconductor devices.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the teachings of *Mimotoga* in combination with the teachings of *Reiser.*

The suggestion for doing so would have been to utilize the *logarithmic dissolution rate calculation* methods of *Reiser* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides improved development of photo resists that are used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method

of semiconductor manufacturing is accomplished, see (Col. 1 lines 66-67 and Col. 2 lines 1-11) of *Reiser*.

Therefore, it would have been obvious to combine *Reiser* with *Mimotoga* to obtain the invention as specified in claims 13 and 15-18.

11.2 Regarding claim 15, *Mimotoga* teaches *where the optical intensities are changed by different photoreaction products* (Col. 10 lines 30-35 note that the positive type resist is a photoreaction product and Col. 9 lines 55-58).

11.3 Regarding claim 16, *Mimotoga* does not expressly disclose, *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to the alkaline concentration.*

However, *Reiser* teaches, *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to the alkaline concentration* (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13 and regarding dissolution Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example, clearly the teaching of *Reiser* disclose the measurement and requirement that the dissolution rates of alkaline concentrations be accounted for in microlithography).

11.4 Regarding claim 17, *Mimotoga* does not expressly disclose, *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to a logarithm of the alkaline concentration.*

However, *Reiser* teaches, *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to a logarithm of the alkaline*

concentration (Figures 1-4, which disclose using logarithmic dissolution rates and regarding the alkaline concentration of the developer see the explanation in Col. 1 lines 48-67 and Col. 2 lines 1-11).

11.5 Regarding claim 18, *Mimotoga* teaches the functional equivalent of *wherein the spatial average is calculated in reference positions moving along development time, which is different from the position where the pattern shape of the photosensitive resist is predicted*, The examiner has interpreted this limitation to required that a prior art teaching disclose at least two regions of interest that are being considered when a spatial average is being calculated, *Mimotagi* teaches, Col. 11 lines 1-50, and teaches 2 regions of interest and their relationship to each other, further in Col. 11 line 11 a *spatial average* is being calculated in regards to the 2 regions of interest. Therefore the examiner believes that the teachings as discussed herein meet a reasonable interpretation of Applicants' claimed limitations.

12. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 as modified by Reiser U.S. Patent 6,319,648 as applied to claims 8 and 10-12 above and further in view of US Patent 6,280,887 Lu.

Mimotogi as modified by *Reiser* teaches calculating optical intensities of a photo-resist and then calculating the dissolution rate in claim 8 for the reasons above, differing from the invention as recited in claim 13 in that their combined teaching lacks,

(claim 14) wherein the optical intensities *are* an aerial image intensity.

Lu teaches (claim 14) wherein the optical intensities are an aerial image intensity (Figures 1D and 1H and Col. 1 lines 55-67 and Col. 3 lines 53-57).

Mimotogi as modified by *Reiser* and *Lu* are analogous art because they are all related to photolithography for integrated circuit fabrication.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the *aerial intensity* methods of *Lu* with the calculation methods of *Mimotogi* as modified by *Reiser* because *Lu* teaches that using the disclosed *aerial intensity* method allows for smaller features sizes in the in integrated circuit patterns allowing for smaller design rules and faster and more power efficient integrated circuits (see *Lu* Col. 15 lines 27-36).

13. Claims 19 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 in view of Reiser U.S. Patent 6,319,648.

13.1 Regarding claim 19, *Mimotoga* teaches, *a computer implemented method for development profile simulation comprising:* (Figure(s) 4, 5 & 9 and the descriptive text and more specifically reference S26 in Figure 5 and Col. 6 lines 14-16 "...Profile Simulation Method...") *calculating optical intensities in a target position to predict a pattern shape of a photosensitive resist and reference positions moving along development time; calculating spatial average values of the optical intensities in the reference positions;* (The examiner has interpreted this limitation to required that a prior art teaching disclose at least two regions of interest that are being considered when a spatial average is being calculated, *Mimotagi* teaches, Col. 11 lines 1-50, and teaches 2 regions of interest and their relationship to each other, further in Col. 11 line 11 a *spatial average* is being calculated in regards to the 2 regions of interest. Therefore the examiner believes that the teachings as discussed herein meet a reasonable interpretation of Applicants' claimed limitations), *obtaining calculated dissolution rates by using the spatial average values in the*

reference positions and the measured changing ratio (Col. 9 lines 4-35 and specifically equation 10, line 29 "...In equation (10), R(x,y) is a dissolution rate distribution converted from a light intensity distribution within the resist film on the basis of the relationship and dissolution rate..." as regards spatial average, see Col. 9 lines 55-58); *and predicting the pattern shape of the photosensitive resist in the target position by using the calculated dissolution rates and the optical intensities in the target position* (Col. 7 lines 26-32, "Thereby a finished profile of a given pattern pitch can be exactly estimated (predicted) and a mask for obtaining a desired pattern can be easily designed..." regarding target position, see also Figure 4 and the descriptive text, Figure 4 discloses an evaluation criteria which is being interpreted as a goal or target for the simulation The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches calculation of the change in the shape of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*).

However *Mimotoga* does not expressly teach, *reading a measured changing ratio of a dissolution rate of the photosensitive resist relating to the alkaline concentration.*

Reiser teaches *reading a measured changing ratio of a dissolution rate of the photosensitive resist relating to the alkaline concentration* (Figures 1-4, which disclose using logarithmic dissolution rates and regarding the alkaline concentration of the developer see the explanation in Col. 1 lines 48-67 and Col. 2 lines 1-11).

Mimotoga and *Reiser* are analogous art because they are from the same problem solving area of microlithography as used in the fabrication of semiconductor devices.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the teachings of *Mimotoga* in combination with the teachings of *Reiser*.

The suggestion for doing so would have been to utilize the *logarithmic dissolution rate calculation* methods of *Reiser* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides improved development of photo resists that are used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method of semiconductor manufacturing is accomplished, see (Col. 1 lines 66-67 and Col. 2 lines 1-11) of *Reiser*.

Therefore, it would have been obvious to combine *Reiser* with *Mimotoga* to obtain the invention as specified in claims 19 and 21-24.

13.2 Regarding claim 21, *Mimotoga* teaches, *wherein the optical intensities is concentration of photoreaction products* (Col. 10 lines 30-35 note that the positive type resist is a photoreaction product and Col. 9 lines 55-58).

13.3 Regarding claim 22, *Mimotoga* does not expressly disclose, *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to the alkaline concentration.*

However, *Reiser* teaches, *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to the alkaline concentration* (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13 and regarding dissolution Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example, clearly the teaching of *Reiser*

disclose the measurement and requirement that the dissolution rates of alkaline concentrations be accounted for in microlithography).

13.4 Regarding claim 23, *Mimotoga* does not expressly disclose, *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to a logarithm of the alkaline concentration.*

However, *Reiser* teaches, *wherein the measured changing ratio of the dissolution rate is calculated from a logarithm of a measured dissolution rate to a logarithm of the alkaline concentration* (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13) and further teaches *dissolution* (Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example).

13.5 Regarding claim 24, *Mimotoga* does not expressly disclose, *wherein the spatial average value is calculated in an area where the photosensitive resist dissolves in initial stage of development,* however Reiser discloses *dissolution* during development of a photo resist (Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example).

14. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 as modified by Reiser U.S. Patent 6,319,648 as applied to claims 19 and 21-24 above and further in view of US Patent 6,280,887 Lu.

Mimotogi as modified by *Reiser* teaches calculating optical intensities of a photo-resist and then calculating the dissolution rate in claims 19 and 21-24 for the reasons above, differing from the invention as recited in claim 13 in that their combined teaching lacks,

(claim 20) wherein the optical intensities *are* an aerial image intensity.

Lu teaches (claim 20) wherein the optical intensities are an aerial image intensity (Figures 1D and 1H and Col. 1 lines 55-67 and Col. 3 lines 53-57).

Mimotogi as modified by *Reiser* and *Lu* are analogous art because they are all related to photolithography for integrated circuit fabrication.

Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the *aerial intensity* methods of *Lu* with the calculation methods of *Mimotogi* as modified by *Reiser* because *Lu* teaches that using the disclosed *aerial intensity* method allows for smaller features sizes in the in integrated circuit patterns allowing for smaller design rules and faster and more power efficient integrated circuits (see *Lu* Col. 15 lines 27-36).

15. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 in view of Reiser U.S. Patent 6,319,648.

15.1 Regarding claim 25 *Mimotogi* teaches, *a computer program product for controlling a computer system so as to simulate development profile,* (Figure(s) 4, 5 & 9 and the descriptive text and more specifically reference S26 in Figure 5 and Col. 6 lines 14-16 "...Profile Simulation Method...") *the computer program product comprising: instructions configured to calculate optical intensities in a photosensitive resist within the computer system;* (Figure 2 and the descriptive text, more specifically Col. 6 lines 45-56 the examiner notes that "calculating light intensity" is functionally equivalent to "calculating optical intensity") *instructions configured to calculate a spatial average value of the optical intensities within the computer system;* (Col. 4 lines 17-18 "...calculating a spatial average...") *instructions configured to obtain a calculated*

dissolution rate by using the spatial average value and the measured changing ratio within the computer system; (Figure 5 and the descriptive text and Col. 4 lines 17-18 and Figure 4 # S3 which discloses a "ratio" in the enclosed formula, further see Col. 9 lines 4-35 and specifically equation 10, line 29 "...In equation (10), R(x,y) is a dissolution rate distribution converted from a light intensity distribution within the resist film on the basis of the relationship and dissolution rate..." as regards spatial average, see Col. 9 lines 55-58), *and concentration changed by at least one of exposure dose on the photosensitive resist, a position in the thickness direction of the photosensitive resist and a concentration of developer for the photosensitive resist within the computer system* (Abstract and Figure 5 #S23) *and instructions configured to predict a pattern shape of the photosensitive resist from the calculated dissolution rate within the computer system* (Col. 7 lines 26-32, "Thereby a finished profile of a given pattern pitch can be exactly estimated (predicted) and a mask for obtaining a desired pattern can be easily designed..." and regarding dissolution rate see Figure 5 # S24 The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches calculation of the change in the shape of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*).

However, *Mimotogi* does not expressly disclose *instructions configured to read a measured changing ratio of a dissolution rate of the photosensitive resist relating to an alkaline concentration.*

Reiser teaches *instructions configured to read a measured changing ratio of a dissolution rate of the photosensitive resist relating to an alkaline* (Figures 1-4 and Col. 4 lines 40-67 and

Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13 and further teaches *dissolution* and see Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example).

Mimotoga and *Reiser* are analogous art because they are from the same problem solving area of microlithography as used in the fabrication of semiconductor devices.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the teachings of *Mimotoga* in combination with the teachings of *Reiser.*

The suggestion for doing so would have been to utilize the *logarithmic dissolution rate calculation* methods of *Reiser* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides improved development of photo resists that are used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method of semiconductor manufacturing is accomplished, see (Col. 1 lines 66-67 and Col. 2 lines 1-11) of *Reiser.*

Therefore, it would have been obvious to combine *Reiser* with *Mimotoga* to obtain the invention as specified in claim 25.

16. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 in view of Reiser U.S. Patent 6,319,648.

16.1 Regarding claim 26 *Minotoga* teaches, *a computer program product for controlling a computer system so as to simulate development profile,* (Figure(s) 4, 5 & 9 and the descriptive text and more specifically reference S26 in Figure 5 and Col. 6 lines 14-16 "...Profile Simulation

Method…"), *the computer program product comprising: instructions configured to calculate optical intensities in a photosensitive resist within the computer system;* (Figure 2 and the descriptive text, more specifically Col. 6 lines 45-56 the examiner notes that "calculating light intensity" is functionally equivalent to "calculating optical intensity") *instructions configured to calculate a spatial average value of optical intensities in an area where the photosensitive resist dissolves in initial stage of development within the computer system* (Figure 5 and the descriptive text and Col. 4 lines 17-18 and Figure 4 # S3 which discloses a "ratio" in the enclosed formula, further see Col. 9 lines 4-35 and specifically equation 10, line 29 "…In equation (10), R(x,y) is a dissolution rate distribution converted from a light intensity distribution within the resist film on the basis of the relationship and dissolution rate…" as regards spatial average, see Col. 9 lines 55-58) *and instructions configured to predict pattern shape of the photosensitive resist by using the calculated dissolution rate within the computer system* (Col. 8 lines 34-67 and Col. 9 lines 1-67 and Figure(s) 2 & 6 and the descriptive text and Figure 9 reference S34 The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches calculation of the change in the shape of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*).

However, *Mimotagi* does not expressly disclose, *instructions configured to obtain a changing ratio of a* <u>*logarithm*</u> *of a measured dissolution rate to an* <u>*alkaline concentration*</u> *of developer for the photosensitive resist or the changing ratio of the* <u>*logarithm*</u> *of the measured dissolution rate to a logarithm of the* <u>*alkaline concentration*</u> *of the developer for the*

photosensitive resist within the computer system; instructions configured to obtain a calculated dissolution rate by using the spatial average value (the examiner notes that *Mimotogi* does teach calculating a *spatial average value*) *and the calculated changing ratio of the* *<u>logarithm</u> of the measured dissolution rate to* *<u>alkaline concentration</u> of the developer or the calculated changing* *<u>ratio of the logarithm</u> of the measured dissolution rate to the logarithm of the* *<u>alkaline</u> concentration of the developer within the computer system.*

Reiser teaches, *instructions configured to obtain a changing ratio of a logarithm of a measured dissolution rate to an alkaline concentration* (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1-10) *of developer for the photosensitive resist or the changing ratio of the logarithm of the measured dissolution rate to a logarithm of the alkaline concentration of the developer for the photosensitive resist within the computer system; instructions configured to obtain a calculated dissolution rate by using the spatial average value* (the examiner notes that *Mimotogi* does teach calculating a *spatial average value*) *and the calculated changing ratio of the logarithm of the measured dissolution rate to alkaline concentration of the developer or the calculated changing ratio of the logarithm of the measured dissolution rate to the logarithm of the alkaline concentration of the developer within the computer system* (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13 and further teaches *dissolution* and see Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example. *Reiser* is being relied upon to teach the known in the art methods of accounting for the changes in the alkaline concentration when determining dissolution rate in a photo resist used in microlithography).

Mimotoga and *Reiser* are analogous art because they are from the same problem solving area of microlithography as used in the fabrication of semiconductor devices.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the teachings of *Mimotoga* in combination with the teachings of *Reiser*.

The suggestion for doing so would have been to utilize the *logarithmic dissolution rate calculation* methods of *Reiser* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides improved development of photo resists that are used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method of semiconductor manufacturing is accomplished, see (Col. 1 lines 66-67 and Col. 2 lines 1-11) of *Reiser*.

Therefore, it would have been obvious to combine *Reiser* with *Mimotoga* to obtain the invention as specified in claim 26.

17. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 in view of Reiser U.S. Patent 6,319,648.

17.1 Regarding claim 27, *Mimotogi* teaches, *a computer program product for controlling a computer system so as to simulate development profile,* (Figure(s) 4, 5 & 9 and the descriptive text and more specifically reference S26 in Figure 5 and Col. 6 lines 14-16 "...Profile Simulation Method..."), *the computer program product comprising: instruction(s) configured to calculate optical intensities in a photosensitive resist within the computer system;* (Figure 2 and the descriptive text, more specifically Col. 6 lines 45-56 the examiner notes that "calculating light

intensity" is functionally equivalent to "calculating optical intensity") *instruction(s) configured to calculate a spatial average value of optical intensities in an area where the photosensitive resist dissolves in initial stage of development within the computer system* (Col. 9 lines 55-58), and *instruction configured to obtain a calculated dissolution rate by using the spatial average value and the measured changing ratio within the computer system* (Figure 5 and the descriptive text and Col. 4 lines 17-18 and Figure 4 # S3 which discloses a "ratio" in the enclosed formula, further see Col. 9 lines 4-35 and specifically equation 10, line 29 "...In equation (10), R(x,y) is a dissolution rate distribution converted from a light intensity distribution within the resist film on the basis of the relationship and dissolution rate...") *and instruction configured to predict a pattern shape of the photosensitive resist by using the calculated dissolution rate within the computer system* (Col. 8 lines 34-67 and Col. 9 lines 1-67 and Figure(s) 2 & 6 and the descriptive text and Figure 9 reference S34 The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches calculation of the change in the shape of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*).

However, *Mimotogi* does not expressly disclose, *instruction(s) configured to read a measured changing ratio of a dissolution rate of the photosensitive resist relating to an alkaline concentration within the computer system; instruction configured to obtain a calculated dissolution rate by using the spatial average value and the measured changing ratio within the computer system.*

Reiser teaches, *instruction(s) configured to read a measured changing ratio of a dissolution rate of the photosensitive resist relating to an* *alkaline concentration* *within the computer system* (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13 and further teaches *dissolution* and see Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example. *Reiser* is being relied upon to teach the known in the art methods of accounting for the changes in the alkaline concentration when determining dissolution rate in a photo resist used in microlithography).

Mimotoga and *Reiser* are analogous art because they are from the same problem solving area of microlithography as used in the fabrication of semiconductor devices.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the teachings of *Mimotoga* in combination with the teachings of *Reiser*.

The suggestion for doing so would have been to utilize the *logarithmic dissolution rate calculation* methods of *Reiser* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides improved development of photo resists that are used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method of semiconductor manufacturing is accomplished, see (Col. 1 lines 66-67 and Col. 2 lines 1-11) of *Reiser*.

Therefore, it would have been obvious to combine *Reiser* with *Mimotoga* to obtain the invention as specified in claim 27.

18. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mimotogi U.S. Patent 5,889,686 in view of Reiser U.S. Patent 6,319,648.

18.1 Regarding claim 28, *Mimotogi* teaches, *a computer program product for controlling a computer system so as to simulate development profile,* (Figure(s) 4, 5 & 9 and the descriptive text and more specifically reference S26 in Figure 5 and Col. 6 lines 14-16 "...Profile Simulation Method..."), *the computer program product comprising: instruction(s) configured to calculate optical intensities in a target position to predict a pattern shape of a photosensitive resist and reference positions moving along development time within the computer system;* (Figure 2 and the descriptive text, more specifically Col. 6 lines 45-56 the examiner notes that "calculating light intensity" is functionally equivalent to "calculating optical intensity") *instruction(s) configured to calculate spatial average values of the optical intensities in the reference positions within the computer system;* (Col. 9 lines 55-58) *instruction(s) configured to obtain calculated dissolution rates by using the spatial average values in the reference positions and the measured changing ratio within the computer system;* (Figure 5 and the descriptive text and Col. 4 lines 17-18 and Figure 4 # S3 which discloses a "ratio" in the enclosed formula, further see Col. 9 lines 4-35 and specifically equation 10, line 29 "...In equation (10), R(x,y) is a dissolution rate distribution converted from a light intensity distribution within the resist film on the basis of the relationship and dissolution rate...") *and instruction(s) configured to predict the pattern shape of the photosensitive resist in the target position by using the calculated dissolution rates and the optical intensities in the target position within the computer system* (Col. 8 lines 34-67 and Col. 9 lines 1-67 and Figure(s) 2 & 6 and the descriptive text and Figure 9 reference S34, The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches

calculation of the change in the shape of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*).

However, *Mimotogi* does not expressly disclose, *instruction(s) configured to read a measured changing ratio of a dissolution rate of the photosensitive resist relating to the alkaline concentration within the computer system.*

Reiser teaches, *instruction(s) configured to read a measured changing ratio of a dissolution rate of the photosensitive resist relating to the alkaline concentration within the computer system* (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13 and further teaches *dissolution* and see Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example. *Reiser* is being relied upon to teach the known in the art methods of accounting for the changes in the alkaline concentration when determining dissolution rate in a photo resist used in microlithography).

Mimotoga and *Reiser* are analogous art because they are from the same problem solving area of microlithography as used in the fabrication of semiconductor devices.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the teachings of *Mimotoga* in combination with the teachings of *Reiser*.

The suggestion for doing so would have been to utilize the *logarithmic dissolution rate calculation* methods of *Reiser* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides improved development of photo resists that are

used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method of semiconductor manufacturing is accomplished, see (Col. 1 lines 66-67 and Col. 2 lines 1-11) of *Reiser*.

Therefore, it would have been obvious to combine *Reiser* with *Mimotoga* to obtain the invention as specified in claim 28.

19. Claims 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gotoh U.S. Patent 6,225,011 in view of Reiser U.S. Patent 6,319,648 and in further view of Mimotogi U.S. Patent 5,889,686.

19.1 Regarding claims 29-32 and using claim 29 as an example, *Gotoh* teaches, *a computer implemented method for mask pattern data correction comprising: reading a designed pattern data in a photosensitive resist, a mask pattern data* (Figure 8 # 104 and Figure 9 and Col. 5 lines 9-28, lines 48-67 and Col. 6 lines 1-29) *and optimizing the mask pattern data so as to make the calculated pattern shape similar to the designed pattern data in the photosensitive resist* (Col. 4 line 12, "Further distortion correction marks disposed within an exposure area in a lattice fashion are prepared in shapes of a plurality of kinds, said shapes are those which can measure the change of the pattern exposure distortion.")

Gotoh fails to teach *a measured changing ratio of a dissolution rate of the photosensitive resist relating to an alkaline concentration changed by at least one of exposure dose on the photosensitive resist.*

Gotoh fails to teach, *a position in the thickness direction of the photosensitive resist, calculating optical intensities in the photosensitive resist; calculating a spatial average value of the optical intensities; obtaining a calculated dissolution rate by using the spatial average value and the measured changing ratio; predicting a pattern shape of the photosensitive resist from the calculated dissolution rate.*

Reiser teaches, *a measured changing ratio of a dissolution rate of the photosensitive resist relating to an alkaline concentration changed by at least one of exposure dose on the photosensitive resist* (Figures 1-4 and Col. 4 lines 40-67 and Col. 5 lines 1–10 and Col. 12 lines 62-67 and Col. 13 lines 1-13 and further teaches *dissolution* and see Example 10C Col. 15 lines 1-10, there are other illustrative examples in *Reiser* this test was chosen as only one such example. *Reiser* is being relied upon to teach the known in the art methods of accounting for the changes in the alkaline concentration when determining dissolution rate in a photo resist used in microlithography).

Mimotogi teaches, *a position in the thickness direction of the photosensitive resist* (Figure 3 and Figure 5 # S22 & S23 and Col. 6 lines 57-65), *calculating optical intensities in the photosensitive resist;* (Figure 9 # S32 and Figure 2 and the descriptive text, more specifically Col. 6 lines 45-56 the examiner notes that "calculating light intensity" is functionally equivalent to "calculating optical intensity") *calculating a spatial average value of the optical intensities;* (Col. 9 lines 55-58) *obtaining a calculated dissolution rate by using the spatial average value and the measured changing ratio;* (Figure 5 and the descriptive text and Col. 4 lines 17-18 and Figure 4 # S3 which discloses a "ratio" in the enclosed formula, further see Col. 9 lines 4-35 and specifically equation 10, line 29 "...In equation (10), R(x,y) is a dissolution rate distribution

converted from a light intensity distribution within the resist film on the basis of the relationship and dissolution rate...") *predicting a pattern shape of the photosensitive resist from the calculated dissolution rate* (Col. 8 lines 34-67 and Col. 9 lines 1-67 and Figure(s) 2 & 6 and the descriptive text and Figure 9 reference S34, The examiner notes that *Mimotagi* discloses the teaching of a simulator and further that *Mimotagi* teaches calculation of the change in the shape of the photosensitive resist, simulators produce predictive results as a function of being simulators, Applicants' claimed limitation of *predicting a pattern shape change* is just the natural result of running the *profile simulation method* as disclosed in *Mimotagi*).

Gotoh, Reiser and *Mimotogi* are analogous art because they are all from the same problem solving area of microlithography.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the *alkaline concentration ratio* method of *Reiser* and the *photosensitive analysis* methods of *Mimotogi* in the *photo mask data correction* methods of *Gotoh* because *Reiser* teaches that the disclosed improved polymer used in aqueous alkali solutions as tested provides improved development of photo resists that are used in microlithography for the semiconductor manufacturing process and by improving the resultant photo resist by increasing the contrast of the semiconductor mask an improved method of semiconductor manufacturing is accomplished, see (*Reiser* Col. 1 lines 66-67 and Col. 2 lines 1-11) and *Mimotogi* teaches, it is desirable to find, by computer simulation, the conditions in advance, under which an optimal resist profile will be developed before actually performing the photolithographic process itself to ensure that a high quality mask pattern is used during the production of semiconductor devices (see *Mimotogi* Col. 1 lines 30-34).

Therefore, it would have been obvious to combine *Reiser* and *Mimotogi* with *Gotoh* to obtain the invention specified in claims 29-32.

Conclusion

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dwin M. Craig whose telephone number is (571) 272-3710. The examiner can normally be reached on 10:00 - 6:00 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul L. Rodriguez can be reached on (571) 272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Dwin McTaggart Craig

12/15/06

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